

GSFC Meteorological - Model - Satellite Products for TRACE-P

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- **Review Scope of Study**
- **GSFC Website Resource Update**
<code916.gsfc.nasa.gov/Missions/TRACEP>
- **Ozone Product Validation, Availability (AMT)**
- **Meteorological - Ozone Connections, other GSFC product evaluation (KEP)**

SCOPE OF GSFC STUDY FOR TRACE-P

- Provide meteorological analyses for flight days based on GSFC-DAO-ASM model - same as used for Harvard-GEOS Model.
- Supply meteorologically based air-mass history (“exposure”) and satellite imagery, e.g.
 - TOMS tropospheric ozone (TDOT method)
 - TOMS aerosols & “Exposure”
 - SeaWIFs aerosols
 - TRMM/LIS lightning flashes & “Exposure”
 - RDFs for PV - show tropical-subtropical-mid-lat-polar air

Above at

<code916.gsfc.nasa.gov/Missions/TRACEP>

Note ! Flight Days only

- Emphasize evaluation of developmental TDOT ozone data.
L See Poster



GSFC Code 916

Atmospheric Chemistry and Dynamics Branch



TRAnsport & Chemical Evolution over the Pacific (TRACE-P)

Mission Planning Images: A NASA/GTE Aircraft Mission

TRACE-P DC-8 Status Updates

TRACE-P P-3B Status Updates

ACE-Asia (Spring 2001)

Mission Analyses for DC-8 and P-3B Flight Days



NEW [CLICK HERE FOR MISSION ANALYSES](#) **NEW**

Note that not all dates within this period may be available.

48 & 72 hour forecasts are generated (Select "current" forecast to get the latest available)

Select Day, Month, Year, Hour and Forecast hour of interest, then click ***SUBMIT***

Year: 2001 Month: March Day: 15 Hour: 00 Forecast: current
SUBMIT

SUMMARY OF MODEL PRODUCTS AND ANALYSES FOR TRACE-P

Product	Image Label in Archive
Air Parcel Exposure to Aircraft Products	Fuel, NO _x , HC, CO [kg/day] EAYYYMMDDHH_FHXX, Theta sfc's = 300, 330, 340
Lightning Exposure	ELYYYMMDDHH_FHXX, Theta sfc's = 300, 330, 340
Reverse domain fill - Modified Potential Vorticity	RDYYYYMMDDHH_FHXX
Meteorological Quantities	PTYYYYMMDDHH_FHXX, Theta sfc's = 300, 330, 340 PPYYYYMMDDHH_FHXX, Press sfc's = 250, 300, 500, 700, 850, 925mb
Dust Exposure	EDYYYYMMDDHH_FHXX, Constant 300 Theta sfc
Regional TOMS Aerosol	TNYYYYMMDD, Daily plots
Global TOMS Aerosol	TSYYYYMMDD, Daily plots
Regional Lightning	LNYYYYMMDD, Daily plots
Global Lightning	LOYYYYMMDD, Daily plots
TOMS Direct Ozone in the Trop.	TDYYYYMMDD, Clear Sky Radiances, Daily plots
SeaWiFS Aerosol Optical Depth -865	SAYYYYMMDD, Overpass Images
SeaWiFS Cloud Imagery	SCYYYYMMDD, Overpass Images
SeaWiFS Angstrom -510	SAYYYYMMDD, Overpass Images
SeaWiFS Chlorophyll (ocean color)	SOYYYYMMDD, Overpass Images

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Last Modified 04-September-2001




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MISSION ANALYSES FOR DC-8 AND P-3B FLIGHT DAYS

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DC-8 Flt #	P-3B Flt #	DATE
	4	2001-February-24
4	5	2001-February-26
5	6	2001-February-27
	7	2001-March-01
6		2001-March-03
	8	2001-March-04
7	9	2001-March-07
8	10	2001-March-09
9	11	2001-March-10
10	12	2001-March-13
11	13	2001-March-17
12	14	2001-March-18
13		2001-March-20
	15	2001-March-21
14	16	2001-March-23
15		2001-March-26
	17	2001-March-27
16		2001-March-29

17	18	2001-March-30
	19	2001-April-02
18	20	2001-April-03
19	21	2001-April-06
	22	2001-April-07
20	23	2001-April-09
	24	2001-April-10

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GSFC-UMD TOMS Ozone Satellite Products

- 1> Tropical Tropospheric Ozone = “TTO” by modified-residual method -

[<metosrv2.umd.edu/~tropo>](http://metosrv2.umd.edu/~tropo)

■ Smoke aerosol/TTO transport in different layers captured in 1997 Indonesian fires.

[Thompson et al., Science, 291, 2128, 2001].

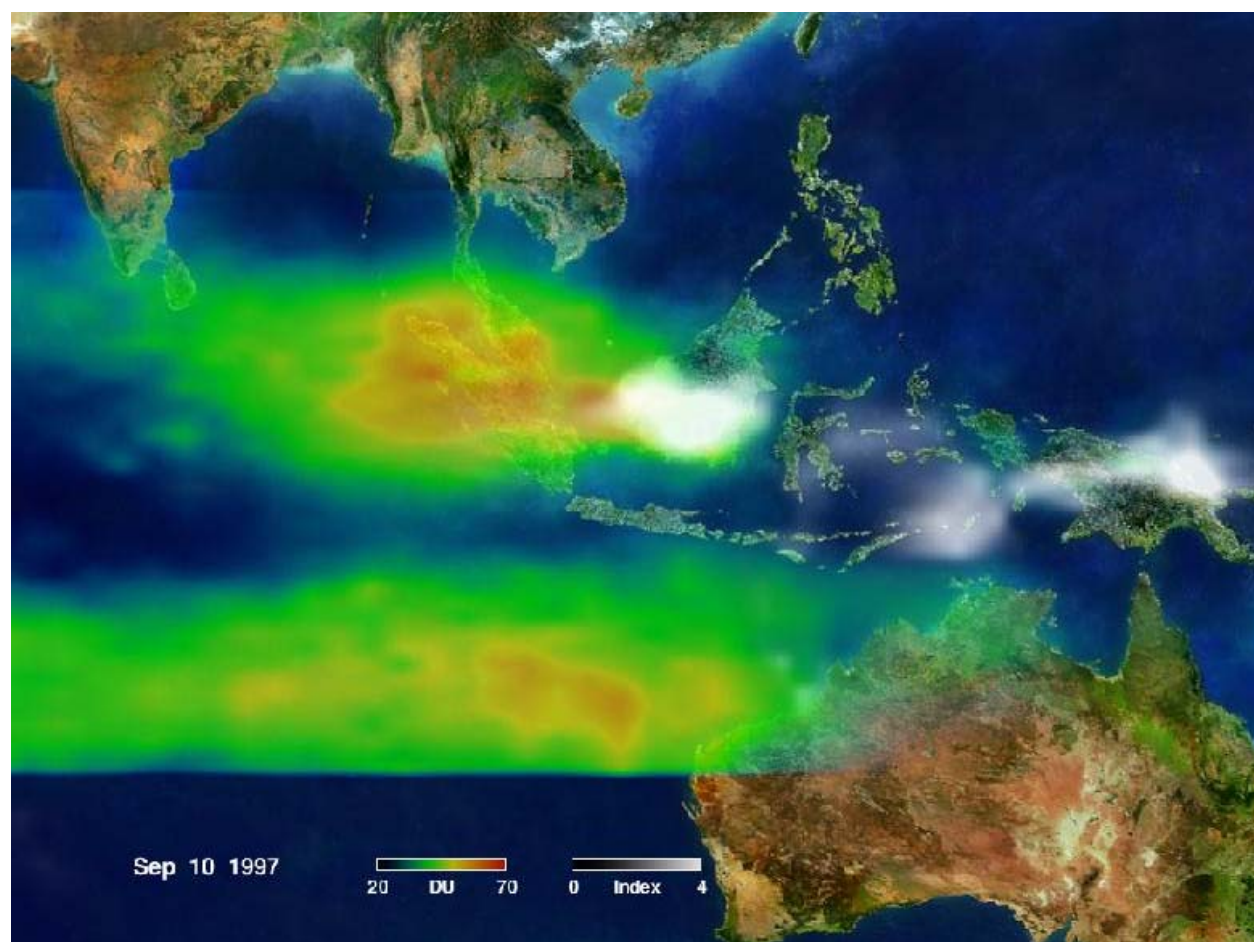
■ Caveat - do not use TTO for TRACE-P until corrected (TOMS scan error).

TOTAL ozone & RDFs display boundaries of polar, mid-latitude, subtropical, tropical air masses. ■ Example - 26 March

- 2> Evaluation of TDO (TOMS-Direct-Ozone-in-Troposphere) is scientific objective for our GSFC TRACE-P effort.

- Compare to Hong Kong, Hilo, 6 Japanese site sondes.
- Compare to ozone from flights, models.

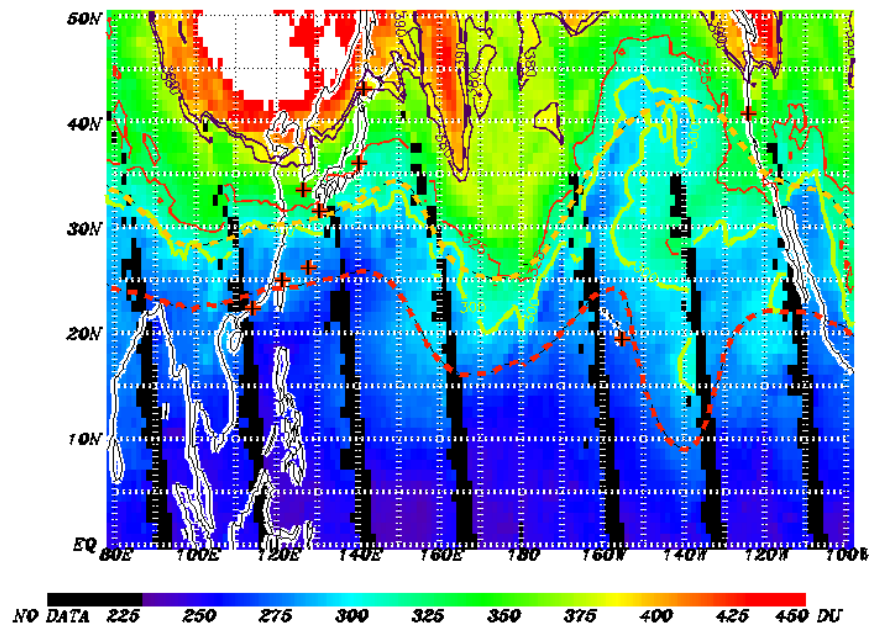
■ Example - 4 March



TOTAL TOMS OZONE

- Daily Level 3 TOMS total ozone & aerosols available from <<http://toms.gsfc.nasa.gov>>.
- Regime-classified Level 2 TOMS by two criteria - Do not always agree NCEP geopotential height (4 times daily) - dash TOMS total ozone - solid.
- Regimes - tropical / sub-tropical-transition / mid-latitude / polar
- TOTAL ozone from 26 March 2001 & RDF (340K, 330K) display similar regime boundaries.
 - Flight from Yokota north to “stratospheric regime” at 10 km confirms polar origins.
 - RDF from GEOS-ASM.
- Collaborative studies anticipated
 - Langley instruments (O3 in-situ, uv-DIAL, other tracers)
 - Langley-Wisc theory group
 - Other models?

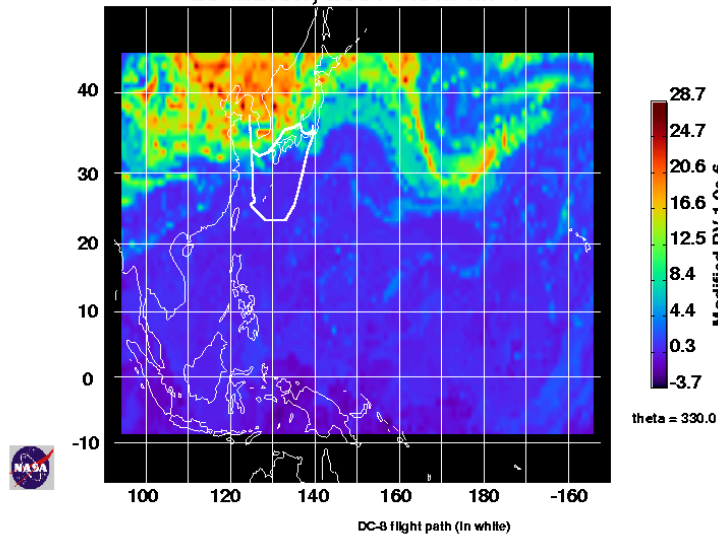
Total O3 from EP-TOMS N3 for 03.26.2001.



out/rdf/out_the330_01032600_FH00_B_8_metASM

Traj Start: 18 March, 2001
Res: 1.00 x 1.00 deg

26 March, 2001 ASM MPV



TDOT TOMS - DIRECT-OZONE-IN TROPOSPHERE

- New algorithm based on TOMS radiances is not a residual type method (cf LaRC, other methods) that starts with TOMS total O₃.
- Physical basis is derivation of tropospheric, strat. O₃ within distinct meteorological regimes where strat O₃ column is fixed [Thompson et al., IGARSS, 2001].
- March 4 shows frontal structure in high TDOT (column ozone, DU) near Hong Kong, Hawaii.
- Collaborative TDOT studies
 - Validation with sondes, DC-8 flight data
 - Evaluate with models
 - GEOS-ASM-CTM
 - NCEP or ECMWF-based CTMs
 - UMD-GEOS-ASM stretched-grid
 - FSU trajectories

TDOT POLLUTION TRANSPORT IN TRACE-P

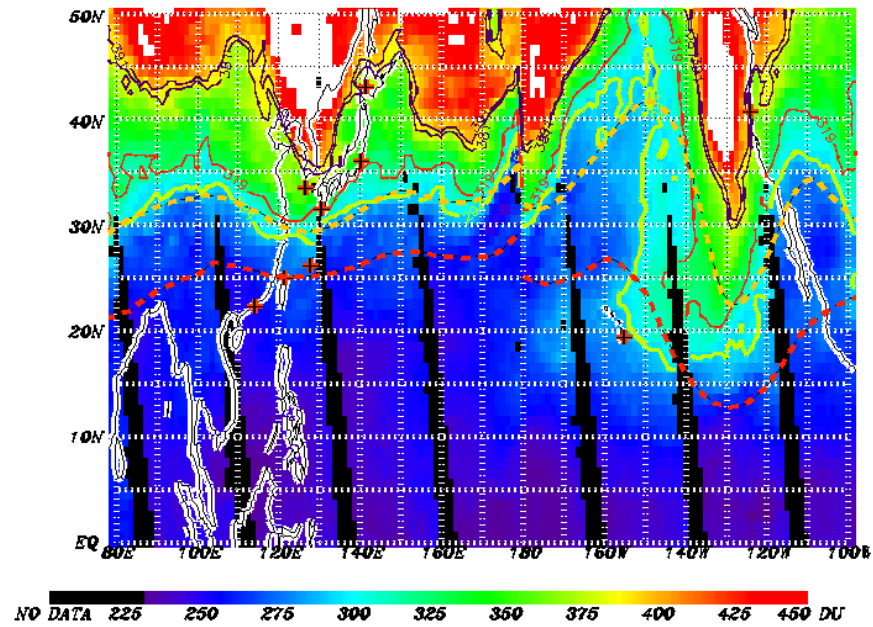
See Total Ozone, TDOT on 4 March 2001

- o Note TDOT has only been derived for tropical air - in principle, TDOT can be obtained in all regimes
- o Orbital gaps present in daily maps; large irregular shaped gaps denote clouds
- o High aerosol or cloud reflectivities preclude accurate aerosol and/or ozone retrieval

Comparison of TDOT & TRACE-P Sondes,
3/2001

- o Agreement for Hong Kong, Naha, Hilo in most cases.
- o Where agreement is poor, station is near a regime boundary, so TDOT is expected to be less accurate. Or nearest clear pixel is far from sonde location, probable cloud interference.

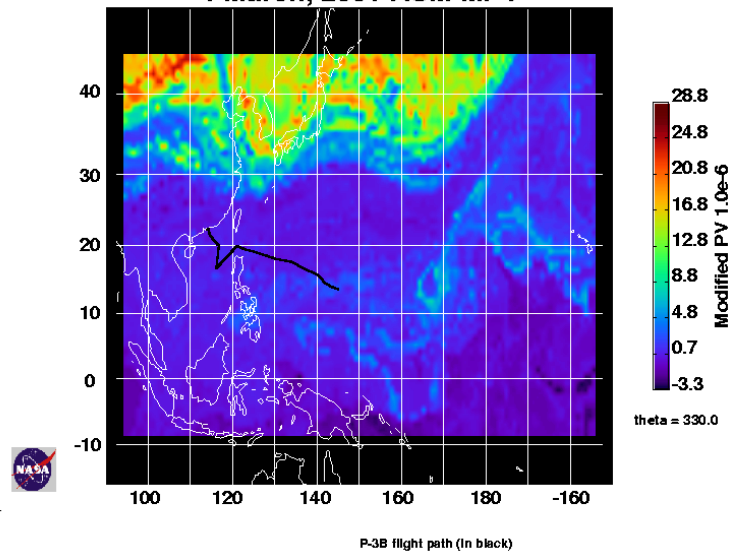
Total O3 from EP-TOMS v3 for 03.04.2001.



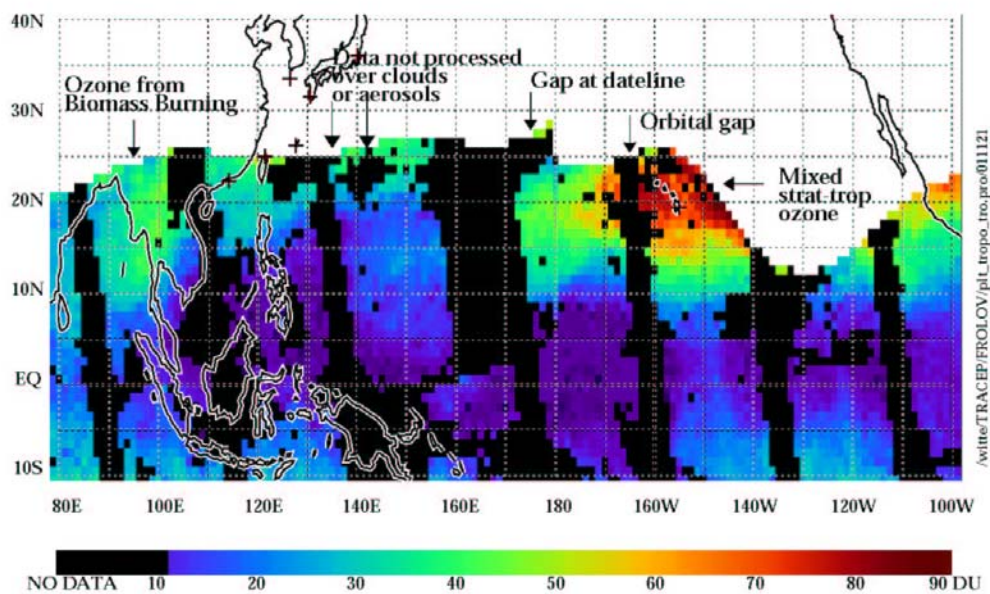
out/rdf/out_the330_01030400_FH00_B_8_metASM

Traj Start: 24 February, 2001
Res: 1.00 x 1.00 deg

4 March, 2001 ASM MPV



TDO from EP-TOMS for 03.04.2001.



PROBLEM: Modified-residual method (also TOMS/SBUV, cloud-slicing) not accurate in extra-tropics where strato. & tropospheric ozone dynamically variable. These methods are error-prone because they start from TOMS total ozone and latitudinally fixed lookup tables.

TDOT Method (TOMS-Direct-Ozone-in-Troposphere)

- 1) Start with meteorologically coherent regions and TOMS radiances instead of derived total ozone. Use pv (potential vorticity) to separate ozone into “regimes.”

Example - July 1999 - Fronts divide regimes (orange & red). Three regimes along 75W longitude (cuts in pv, total ozone)

- Tropical, sub-tropical, mid-latitude
- Sub-tropical air in July reaches to mid-latitude

2) Re-derive Total Ozone & Stratospheric Ozone

Ozone values from B pair approach [Dave & Mateer, 1976]. Select strat. O3 corresponding to max. total O3 (251 DU)

3) Devise New Lookup Tables

Opposite principle from standard TOMS -- create new lookup tables w/ varying tropospheric O₃ + fixed strato. O₃. Fixed tropopause assumed - 15.8 km

4) Retrieve Tropospheric Ozone

Only from cloud-free radiances; std. Level 3 grid (1x1.25°)

5) Error Analysis:

Combined Stratos. + Tropo. ozone uncertainty is 11 DU.

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Bibliography-

GSFC SHADOZ = Southern Hemisphere Additional OZonesondes

http://code916.gsfc.nasa.gov/Data_services/shadoz

UMD/GSFC TTO Web Page

<http://metosrv2.umd.edu/~tropo> - Modified-residual maps & data

GSFC/UMD TDOT & aerosol maps for Feb-April 2000 (click on TD, TR, TN)

<http://code916.gsfc.nasa.gov/Missions/TRACEP>

NASA-Goddard TOMS Web Page – <http://toms.gsfc.nasa.gov>

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